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1   Reconstruction and triangulation: Efficient estimation of 3D Euclidean distance fields   ◼
    from 2D range images
    Sarah F. Frisken, Ronald N. Perry
    October 2002 **Proceedings of the 2002 IEEE symposium on Volume visualization and
                 graphics**
    Full text available: 📄 pdf(12.39 MB)   Additional Information: full citation, abstract, references, index terms

    Several existing algorithms for reconstructing 3D models from range data first approximate
    the object's 3D distance field to provide an implicit representation of the scanned object
    and then construct a surface model of the object using this distance field. In these existing
    approaches, computing and storing 3D distance values from range data contribute
    significantly to the computational and storage requirements. This paper presents an
    efficient method for estimating the 3D Euclidean distance fi ...

    Keywords: 3D scanning, ADFs, distance fields, range images

2   Adaptively sampled distance fields: a general representation of shape for computer   ◼
    graphics
    Sarah F. Frisken, Ronald N. Perry, Alyn P. Rockwood, Thouis R. Jones
    July 2000 **Proceedings of the 27th annual conference on Computer graphics and
               interactive techniques**
    Full text available: 📄 pdf(476.42 KB)   Additional Information: full citation, abstract, references, citings, index
                                                                     terms

    Adaptively Sampled Distance Fields (ADFs) are a unifying representation of shape that
    integrate numerous concepts in computer graphics including the representation of geometry
    and volume data and a broad range of processing operations such as rendering, sculpting,
    level-of-detail management, surface offsetting, collision detection, and color gamut
    correction. Its structure is uncomplicated and direct, but is especially effective for quality
    reconstruction of complex shapes, e.g., artistic a ...

    Keywords: carving, distance fields, graphics, implicit surfaces, level of detail, rendering,
    volume modeling, volume rendering

3   ◼
    Session P8: isosurfaces and distance fields: A complete distance field representation

Jian Huang, Yan Li, Roger Crawfis, Shao Chiung Lu, Shuh Yuan Liou
October 2001 **Proceedings of the conference on Visualization '01**

Full text available: 📄 pdf(356.82 KB)   Additional Information: <u>full citation</u>, <u>abstract</u>, <u>references</u>, <u>index terms</u>
📄 Publisher Site

Distance fields are an important volume representation. A high quality distance field facilitates accurate surface characterization and gradient estimation. However, due to Nyquist's Law, no existing volumetric methods based on the linear sampling theory can fully capture surface details, such as corners and edges, in 3D space. We propose a novel complete distance field representation (CDFR) that does not rely on Nyquist's sampling theory. To accomplish this, we construct a volume where each vox ...

Keywords: distance fields, graphics, point-based models, polygonal surfaces, volume modeling

4 Kizamu: a system for sculpting digital characters
Ronald N. Perry, Sarah F. Frisken
August 2001 **Proceedings of the 28th annual conference on Computer graphics and interactive techniques**

Full text available: 📄 pdf(4.04 MB)   Additional Information: <u>full citation</u>, <u>abstract</u>, <u>references</u>, <u>citings</u>, <u>index terms</u>

This paper presents Kizamu, a computer-based sculpting system for creating digital characters for the entertainment industry. Kizamu incorporates a blend of new algorithms, significant technical advances, and novel user interaction paradigms into a system that is both powerful and unique.

To meet the demands of high-end digital character design, Kizamu addresses three requirements posed to us by a major production studio. First, animators and artists want *digital clay* — a ...

Keywords: ADFs, character design, digital sculpting, distance fields, graphics systems, rendering, triangulation, volume modeling

5 Fast Monte Carlo domain sampling for discrete field value estimation
K. Suresh, J. Lagajac
May 1997 **Proceedings of the fourth ACM symposium on Solid modeling and applications**

Full text available: 📄 pdf(1.47 MB)   Additional Information: <u>full citation</u>, <u>references</u>, <u>index terms</u>

6 Reverse Engineering: A local coordinate system on a surface
Jean-Daniel Boissonnat, Julia Flototto
June 2002 **Proceedings of the seventh ACM symposium on Solid modeling and applications**

Full text available: 📄 pdf(521.79 KB)   Additional Information: <u>full citation</u>, <u>abstract</u>, <u>references</u>, <u>citings</u>, <u>index terms</u>

Coordinate systems associated to a finite set of sample points have been extensively studied, especially in the context of interpolation of multivariate scattered data. Notably, Sibson proposed the so-called natural neighbor coordinates that are defined from the Voronoi diagram of the sample points. A drawback of those coordinate systems is that their definition domain is restricted to the convex hull of the sample points. This make them difficult to use when the sample points belong to a surfac ...

7 The Quadtree and Related Hierarchical Data Structures

Hanan Samet

June 1984 **ACM Computing Surveys (CSUR)**, Volume 16 Issue 2

Full text available: pdf(4.87 MB)   Additional Information: full citation, references, citings, index terms

8 The directional parameter plane transform of a height field

David W. Paglieroni

January 1998 **ACM Transactions on Graphics (TOG)**, Volume 17 Issue 1

Full text available: pdf(630.30 KB)   Additional Information: full citation, abstract, references, index terms, review

The linear Parameter Plane Transform (PPT) of a height field attributes an inverted cone of empty space to each height field cell. In is known that height field ray-tracing efficiency can be improved by traversing rays in steps across inverted cones of empty space. However, steps across inverted cones of empty space along rays close to the base of a steep ridge will be short, even if there are no obstructions along the line of sight, because the cones will be narrow. This w ...

Keywords: directional distance transform, directional parameter plane transform, height field, ray tracing, terrain visualization

9 Voronoi diagrams—a survey of a fundamental geometric data structure

Franz Aurenhammer

September 1991 **ACM Computing Surveys (CSUR)**, Volume 23 Issue 3

Full text available: pdf(5.18 MB)   Additional Information: full citation, references, citings, index terms

Keywords: cell complex, clustering, combinatorial complexity, convex hull, crystal structure, divide-and-conquer, geometric data structure, growth model, higher dimensional embedding, hyperplane arrangement, k-set, motion planning, neighbor searching, object modeling, plane-sweep, proximity, randomized insertion, spanning tree, triangulation

10 A survey of methods for recovering quadrics in triangle meshes

Sylvain Petitjean

June 2002 **ACM Computing Surveys (CSUR)**, Volume 34 Issue 2

Full text available: pdf(3.91 MB)   Additional Information: full citation, abstract, references, citings, index terms

In a variety of practical situations such as reverse engineering of boundary representation from depth maps of scanned objects, range data analysis, model-based recognition and algebraic surface design, there is a need to recover the shape of visible surfaces of a dense 3D point set. In particular, it is desirable to identify and fit simple surfaces of known type wherever these are in reasonable agreement with the data. We are interested in the class of quadric surfaces, that is, algebraic surfa ...

Keywords: Data fitting, geometry enhancement, local geometry estimation, mesh fairing, shape recovery

11 Gross motion planning—a survey

Yong K. Hwang, Narendra Ahuja
September 1992 **ACM Computing Surveys (CSUR),** Volume 24 Issue 3

Full text available: pdf(6.40 MB)   Additional Information: <u>full citation</u>, <u>abstract</u>, <u>references</u>, <u>citings</u>, <u>index terms</u>, <u>review</u>

Motion planning is one of the most important areas of robotics research. The complexity of the motion-planning problem has hindered the development of practical algorithms. This paper surveys the work on gross-motion planning, including motion planners for point robots, rigid robots, and manipulators in stationary, time-varying, constrained, and movable-object environments. The general issues in motion planning are explained. Recent approaches and their performances are briefly described, a ...

Keywords: collision detection, computational geometry, implementation, motion planning, obstacle avoidance, path planning, spatial representation

12 Skeletal/medial axis representations: Efficient computation of a simplified medial axis

Mark Foskey, Ming C. Lin, Dinesh Manocha
June 2003 **Proceedings of the eighth ACM symposium on Solid modeling and applications**

Full text available: pdf(890.34 KB)   Additional Information: <u>full citation</u>, <u>abstract</u>, <u>references</u>, <u>index terms</u>

Applications of of the medial axis have been limited because of its instability and algebraic complexity. In this paper, we use a simplification of the medial axis, the θ-SMA, that is parameterized by a separation angle (θ) formed by the vectors connecting a point on the medial axis to the closest points on the boundary. We present a formal characterization of the degree of simplification of the θ-SMA as a function of θ, and we quantify the degree ...

Keywords: distance field, medial axis

13 Efficient algorithms for geometric optimization

Pankaj K. Agarwal, Micha Sharir
December 1998 **ACM Computing Surveys (CSUR)**, Volume 30 Issue 4

Full text available: pdf(577.74 KB)   Additional Information: <u>full citation</u>, <u>abstract</u>, <u>references</u>, <u>citings</u>, <u>index terms</u>

We review the recent progress in the design of efficient algorithms for various problems in geometric optimization. We present several techniques used to attack these problems, such as parametric searching, geometric alternatives to parametric searching, prune-and-search techniques for linear programming and related problems, and LP-type problems and their efficient solution. We then describe a wide range of applications of these and other techniques to numerous problems in geometric optim ...

Keywords: clustering, collision detection, linear programming, matrix searching, parametric searching, proximity problems, prune-and-search, randomized algorithms

14 Sensor networks: Lightweight sensing and communication protocols for target enumeration and aggregation

Qing Fang, Feng Zhao, Leonidas Guibas
June 2003 **Proceedings of the 4th ACM international symposium on Mobile ad hoc networking & computing**

Full text available: pdf(331.14 KB)   Additional Information: <u>full citation</u>, <u>abstract</u>, <u>references</u>, <u>index terms</u>

The development of lightweight sensing andcommunication protocols is a key requirement for designing resource constrained sensor networks. This paper introduces a set of efficient

protocols and algorithms, DAM, EBAM, and EMLAM, for constructing and maintaining sensor aggregates that collectively monitor target activity in the environment. A sensor aggregate comprises those nodes in a network that satisfy a grouping predicate for a collaborative processing task. The parameters of the predicate de ...

Keywords: applications for ad hoc networks, distributed algorithms for ad hoc networks, processing and fusion of data in sensor networks, self-configuration in ad hoc networks

15 A procedural approach to authoring solid models

Barbara Cutler, Julie Dorsey, Leonard McMillan, Matthias Müller, Robert Jagnow
July 2002 **ACM Transactions on Graphics (TOG) , Proceedings of the 29th annual conference on Computer graphics and interactive techniques**, Volume 21 Issue 3

Full text available: pdf(11.99 MB)   Additional Information: full citation, abstract, references, citings, index terms

We present a procedural approach to authoring layered, solid models. Using a simple scripting language, we define the internal structure of a volume from one or more input meshes. Sculpting and simulation operators are applied within the context of the language to shape and modify the model. Our framework treats simulation as a modeling operator rather than simply as a tool for animation, thereby suggesting a new paradigm for modeling as well as a new level of abstraction for interacting with si ...

Keywords: signed-distance function, tetrahedral representation, volumetric modeling

16 Fixing models: Context-based surface completion

Andrei Sharf, Marc Alexa, Daniel Cohen-Or
August 2004 **ACM Transactions on Graphics (TOG)**, Volume 23 Issue 3

Full text available: pdf(758.83 KB)   Additional Information: full citation, abstract, references, index terms

Sampling complex, real-world geometry with range scanning devices almost always yields imperfect surface samplings. These "holes" in the surface are commonly filled with a smooth patch that conforms with the boundary. We introduce a context-based method: the characteristics of the given surface are analyzed, and the hole is iteratively filled by copying patches from valid regions of the given surface. In particular, the method needs to determine best matching patches, and then, fit imported patc ...

17 Image Models

Narendra Ahuja, B. J. Schachter
December 1981 **ACM Computing Surveys (CSUR)**, Volume 13 Issue 4

Full text available: pdf(2.99 MB)   Additional Information: full citation, references, citings, index terms

18 Self-spacial join selectivity estimation using fractal concepts

Alberto Belussi, Christos Faloutsos
April 1998 **ACM Transactions on Information Systems (TOIS)**, Volume 16 Issue 2

⁰ Full text available: pdf(2.28 MB)   Additional Information: full citation, abstract, references, citings, index terms

The problem of selectivity estimation for queries of nontraditional databases is still an open issue. In this article, we examine the problem of selectivity estimation for some types of spatial queries in databases containing real data. We have shown earlier [Faloutsos and Kamel 1994] that real point sets typically have a nonuniform distribution, violating consistently the uniformity and independence assumptions. Moreover, we demonstrated that the theory of ...

Keywords: fractal dimension, range query, selectivity estimation, spatial join

19 Surface reconstruction by Voronoi filtering

Nina Amenta, Marshall Bern

June 1998 **Proceedings of the fourteenth annual symposium on Computational geometry**

Full text available: pdf(1.27 MB)   Additional Information: full citation, references, citings, index terms

20 Index-driven similarity search in metric spaces

Gisli R. Hjaltason, Hanan Samet

December 2003 **ACM Transactions on Database Systems (TODS)**, Volume 28 Issue 4

Full text available: pdf(650.64 KB)   Additional Information: full citation, abstract, references, index terms

Similarity search is a very important operation in multimedia databases and other database applications involving complex objects, and involves finding objects in a data set S similar to a query object q, based on some similarity measure. In this article, we focus on methods for similarity search that make the general assumption that similarity is represented with a distance metric d. Existing methods for handling similarity search in this setting typically fall into one of ...

Keywords: Hiearchical metric data structures, distance-based indexing, nearest neighbor queries, range queries, ranking, similarity searching

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1 **Hardware-accelerated visualization of volume-sampled distance fiel**
Yamazaki, S.; Kase, K.; Ikeuchi, K.;
Shape Modeling International, 2003 , 12-15 May 2003
Pages:264 - 271

[Abstract]   [PDF Full-Text (919 KB)]   **IEEE CNF**

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2 **Revisiting adaptively sampled distance fields**
de Figueiredo, L.H.; Velho, L.; de Oliveira, J.B.;
Computer Graphics and Image Processing, 2001 Proceedings of XIV Brazilian
Symposium on , 15-18 Oct. 2001
Pages:377

[Abstract]   [PDF Full-Text (128 KB)]   **IEEE CNF**

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3 **Efficient estimation of 3D Euclidean distance fields from 2D range
images**
Frisken, S.F.; Perry, R.N.;
Volume Visualization and Graphics, 2002. Proceedings. IEEE / ACM SIGGRAPH
Symposium on , 28-29 Oct. 2002
Pages:81 - 88

[Abstract]   [PDF Full-Text (719 KB)]   **IEEE CNF**

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1 **Efficient estimation of 3D Euclidean distance fields from 2D range
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Frisken, S.F.; Perry, R.N.;
Volume Visualization and Graphics, 2002. Proceedings. IEEE / ACM SIGGRAPH
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